

Innovations in Understanding and Modeling Cryogenic Propellants for Long-Duration Spaceflight

Completed Technology Project (2013 - 2018)



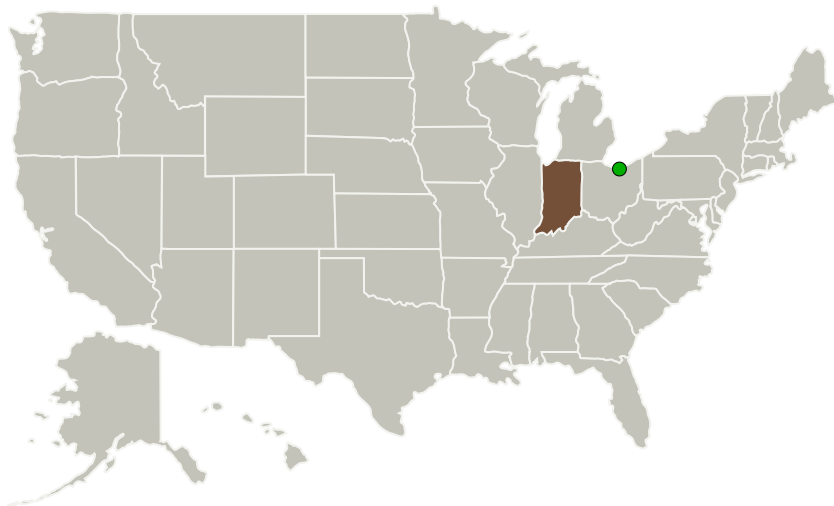
Project Introduction

Space exploration by humans and robots benefits from optimization of many systems. Design of cryogenic rocket systems, typically using liquid oxygen and liquid hydrogen or liquid methane, is crucial to do as well as possible so as to be able to deliver the space vehicle to where the exploration and scientific research can occur. Warming of these chilled propellants shortens mission lifetimes, drives up cost, and, when poorly controlled, prohibits us from even attempting some missions. This research focuses on delivering much-needed improvements to how we model the heat transfer processes, such as warming and the use of chillers, with cryogenic propellants. Unique ground-based experiments along with detailed computer modeling of evaporation, condensation, motion, and heat transfer in the liquid and vapor phases are combined to open up the details of how fast these propellants move heat and mass around the fuel tanks in space by evaporation and condensation. This will permit designers to better optimize spaceflight systems to enable new missions, increase affordability, and reduce risk.

Anticipated Benefits

This will permit designers to better optimize spaceflight systems to enable new missions, increase affordability, and reduce risk.

Primary U.S. Work Locations and Key Partners



Innovations in Understanding and Modeling Cryogenic Propellants for Long-Duration Spaceflight

Table of Contents

Project Introduction	1
Anticipated Benefits	1
Primary U.S. Work Locations and Key Partners	1
Project Website:	2
Organizational Responsibility	2
Project Management	2
Technology Maturity (TRL)	2
Technology Areas	3
Target Destinations	3

Innovations in Understanding and Modeling Cryogenic Propellants
for Long-Duration Spaceflight

Completed Technology Project (2013 - 2018)



Organizations Performing Work	Role	Type	Location
Purdue University-Main Campus	Lead Organization	Academia	West Lafayette, Indiana
● Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations

Indiana

Project Website:

<https://www.nasa.gov/strg#.VQb6T0jJzyE>

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Purdue University-Main Campus

Responsible Program:

Space Technology Research Grants

Project Management

Program Director:

Claudia M Meyer

Program Manager:

Hung D Nguyen

Principal Investigator:

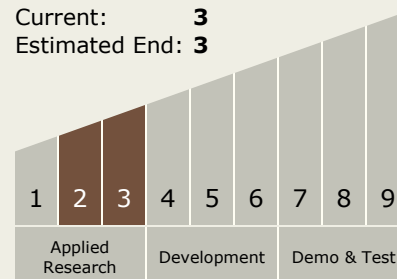
Steven H Collicott

Technology Maturity (TRL)

Start: 2

Current: 3

Estimated End: 3



Innovations in Understanding and Modeling Cryogenic Propellants for Long-Duration Spaceflight

Completed Technology Project (2013 - 2018)



Technology Areas

Primary:

- TX01 Propulsion Systems
 - └ TX01.1 Chemical Space Propulsion
 - └ TX01.1.3 Cryogenic

Target Destinations

Mars, Others Inside the Solar System